Radioactivity

Each atom has at least one isotope, many having a great number of isotopes. An isotope is a combination of neutrons and protons present in an atom. For a full lesson on isotopes and their notation, read the page at the previous link.

One of the problems so often discussed about nuclear power is leakage of unstable or radioactive isotopes from a plant. Radioactivity means that an element loses its mass over time and becomes smaller. The amount of time over which an element will break down is independent for each isotope. Several different kinds of "break downs" occur within radioactive isotopes. Each process of radioactive decay asserts a different strength on the surrounding environment. This strength is termed radiation. The chemical equations for the decay procedure that exists in some isotopes are presented here:

Type of Decay & Reaction	**Strength of Radiation**
Alpha, $238_{92}U \rightarrow 4_{2}He + 234_{90}Th$	Can be stopped by several sheets of ordinary paper or clothing.
Beta, $14_{6}C \rightarrow 0_{-1}Beta + 14_{5}B$	.125 inches of aluminum are needed to stop beta particles.
Gamma, $40_{19}K \rightarrow 0_{0}Gamma + 40_{19}K$	Can pass through the human body. Thick lead or concrete are needed as protection.

The amount of time it takes the element to decay to half of its mass is called an isotopes's half life. Different element's half lifes are measured in seconds or days or even years. Some of the half lifes of the elements involved in the nuclear decomposition reaction are shown in the following table:

Radioactive Isotope, Type of Decay	**Half Life**
Carbon-14, beta decay	5730 years
Uranium-238, alpha decay	$4.47 * 10^{9}$ years, or 4470000000 years
Amercium-241, alpha decay	432 years
Arsenic-74, beta decay	17.9 days

Radioactive Series

Some radioactive isotopes decay into other nonstable isotopes. This process can go on for a very long time, determined by the different half lifes of each of the isotopes. One of the largest radioactive series is 15 elements long! Its process is shown below:

Isotope, Type of Decay	Half Life
U-238, alpha	10^9 years
Th-234, beta	24 days
Pa-234, beta	1.2 minutes
U-234, alpha	10^5 years
Th-230, alpha	10^4 years
Ra-226, alpha	1622 years
Rn-222, alpha	3.8 days
Po-218, beta	3.0 minutes
At-218, alpha	1.4 seconds
Bi-214, beta	20 minutes
Po-214, alpha	164 microseconds
Pb-210, beta	21 years
Bi-210, beta	5 days
Po-210, alpha	138 days
Pb-206 stable	

Several equation represent radioactivity. Because a half life is the amount of time that it takes for any radioactive isotope to lose half of its mass.

Timespan * halflife = amount left

Do these nuclear problems, and quiz yourself on these radioactive concepts.